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Two new species of *Cymodusa* Holmgren (Hymenoptera, Ichneumonidae) with a key to species known from China and Oriental region

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Abstract

Two new species of genus *Cymodusa* Holmgren, 1859, *C. culaiica* Sheng, Li & Sun, **sp.nov.** collected from Culaishan Natural Reserve, Shandong province and *C. melana* Sheng, Li & Sun, **sp.nov.** collected from Guiyang and Fanjingshan National Natural Reserve, Guizhou province, are described and illustrated. A taxonomic key to the species of *Cymodusa* from China and the Oriental region is provided.

Keywords

Campopleginae, new species, Key, taxonomy

Introduction

Cymodusa Holmgren, 1859 (Hymenoptera, Ichneumonidae, Campopleginae) comprises 43 species (Yu et al. 2016; Watanabe 2020), of which seven are from the Oriental region (two of them occur in the Eastern Palaearctic region, one also occurs in the Western Palaearctic) (Holmgren 1859; Cameron 1905; Uchida 1956; Gupta & Gupta

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1974), 18 from the Eastern Palaearctic region (seven occur in the Western Palaearctic region, one also occurs in the Western Palaearctic and Nearctic regions) (Uchida 1956; Aubert 1974; Sawoniewicz 1978; Dbar 1984, 1985; Choi et al. 2013; Yu et al. 2016; Watanabe 2020), 18 from the Western Palaearctic region (Dbar 1984; 1985, Kolarov & Yurtcan 2008; Yu et al. 2016), ten from the Nearctic (Sanborne 1986, 1990) and two from the Neotropical region, which also occur in the Nearctic (Sanborne 1986). Prior to the present study, two species, *C. josephi* Gupta & Gupta, 1974 and *C. orientalis* Uchida, 1956, have been recorded from China (Gupta & Gupta 1974; Dbar 1985).

The Oriental species of *Cymodusa* Holmgren and a key to the known species from this region were reported by Gupta & Gupta (1974). The Palaearctic species of *Cymodusa* were revised by Dbar (1984, 1985). A key to species from the Russian Far East was provided by Khalaim & Kasparyan (2007). The Korean species were reported by Choi et al. (2013). Watanabe (2020) revised the Japanese species of *Cymodusa*, and synonymized *C. aenigma* Dbar, 1985 with *C. orientalis* Uchida, 1956.

Ten host species of *Cymodusa*, mainly belonging to families Crambidae, Gelechiidae, Geometridae, Erebidae, Pyralidae, Yponomeutidae, have been recorded (Meyer 1935; Talhouk 1961; Pisica & Petcu 1972; Dbar 1984; Kusigemati 1976; Heckford & Sterling 2005; Lozan et al. 2012).

In this paper two new species of *Cymodusa* and a key to known species from China and the Oriental region are reported.

Material and methods

Specimens were collected by interception traps (IT) (Li et al. 2012) in Culaishan Natural Reserve, Tai'an, Shandong Province; Panlongshan, Wudang, Guiyang and Fanjingshan National Natural Reserve, Guizhou Province, China.

Images were taken using a Leica M205A stereomicroscope with LAS Montage MultiFocus. Morphological terminology is based on Broad et al. (2018). All specimens are deposited in the Insect Museum, General Station of Forest and Grassland Pest Management, National Forestry and Grassland Administration, P. R. China.

Taxonomy

Cymodusa Holmgren, 1859

Cymodusa Holmgren, 1859:327. Type-species: *Cymodusa leucocera* Holmgren.

Diagnosis. Eyes with setae. Inner margins of eyes weakly indented opposite antennal socket. Face strongly convergent ventrally (especially in female). Mandible short, lower edge with a narrow flange, or as a high carina; upper tooth usually as long as lower

tooth. Malar space very short, or absolutely wanting in female. Posterior transverse carina of mesosternum complete. Propodeal spiracle circular. Glymma absent. Ovipositor stout, compressed, almost straight.

Key to the species known from China and the Oriental region

1 Hind wing nervellus not intercepted, discoidella absent **2**
– Hind wing nervellus intercepted, discoidella present, usually unpigmented..... **4**
2 Malar space 0.25–0.26× basal width of mandible. Anterior tentorial pit distinctly distant from eyes. Metasomal tergites entirely black. Proximal flagellomeres white..... ***C. antennator* Holmgren, 1860**
– Malar space at most 0.15× basal width of mandible. Anterior tentorial pit almost obscured. At least part of metasomal tergites red to brownish red. Flagellomeres almost entirely black **3**
3 Area basalis (Fig. 7) elongate, at least 2.5× as long as anterior width. Antenna with 24–25 flagellomeres. Hind leg except tarsus yellowish to reddish brown .... ***C. culaiica* Sheng, Li & Sun, sp.nov.**
– Area basalis relatively short, at most 2.0× as long as anterior width. Antenna with 29–34 flagellomeres. Hind leg mostly brownish black .... ***C. orientalis* Uchida, 1956**
4 Area basalis, area superomedia and area petiolaris of propodeum completely confluent. Areolet receiving 2m-cu distinctly basal of its middle. Fourth tergite entirely red. Tegula yellowish white. Hind coxa black.... ***C. dravida* Gupta & Gupta, 1974**
– At least area basalis distinctly separated from area superomedia by transverse carina. Areolet receiving 2m-cu almost at its middle. Fourth tergite entirely or partly black. Tegula and hind coxa with different coloration **5**
5 Area basalis of propodeum with lateral carinae parallel, 3.0× as long as wide. Area externa finely rugose. Hind coxa and all metasomal tergies black .... ***C. taprobanicum* (Cameron, 1905)**
– Area basalis of propodeum at most 2.0× as long as wide, more or less convergent. Area externa with different sculpture. Hind coxa or metasomal tergites (except *C. melana*) not entirely black **6**
6 Malar space 0.25–0.35× basal width of mandible. Postocellar line 0.9–1.0 × as long as ocular-ocellar line. Hind basitarsus 2× as long as hind tibial spur. Hind coxa and femur black ..... ***C. shiva* Gupta & Gupta, 1974**
– Malar space wanting, or at most 0.15× basal width of mandible. Postocellar line at least 1.2× as long as ocular-ocellar line. Hind basitarsus at least 2.3× as long as hind tibial spur. Hind coxa and femur (except *C. melana*) not entirely black..... **7**
7 Tergite 2 granulose in anterior portion, posterior portion and subsequent tergites subpolished. Tergites 2–4 with posterior transverse red bands .... ***C. santoshae* Gupta & Gupta, 1974**
– Tergites 2 and 3 granulose. Metasomal tergites entirely or almost entirely black.... **8**

8 Dorsal median portion of occipital carina evenly arched. Lateral carinae of area basalis convergent posteriorly, 2× as long as wide. Tergite 2 as long as tergite 1. 1cu-a opposite M&RS. Claw pectinate subbasally. Posterior margin of tergite 2 red ..... ***C. josephi* Gupta & Gupta, 1974**

– Dorsal median portion of occipital carina (Fig. 14) angled. Lateral carinae of area basalis slightly divergent posteriorly, 1.2–1.3× as long as wide. Second tergite shorter than first. 1cu-a basal of M&RS. Claw almost simple. All tergites entirely black. ..... ***C. melana* Sheng, Li & Sun, sp.nov.**

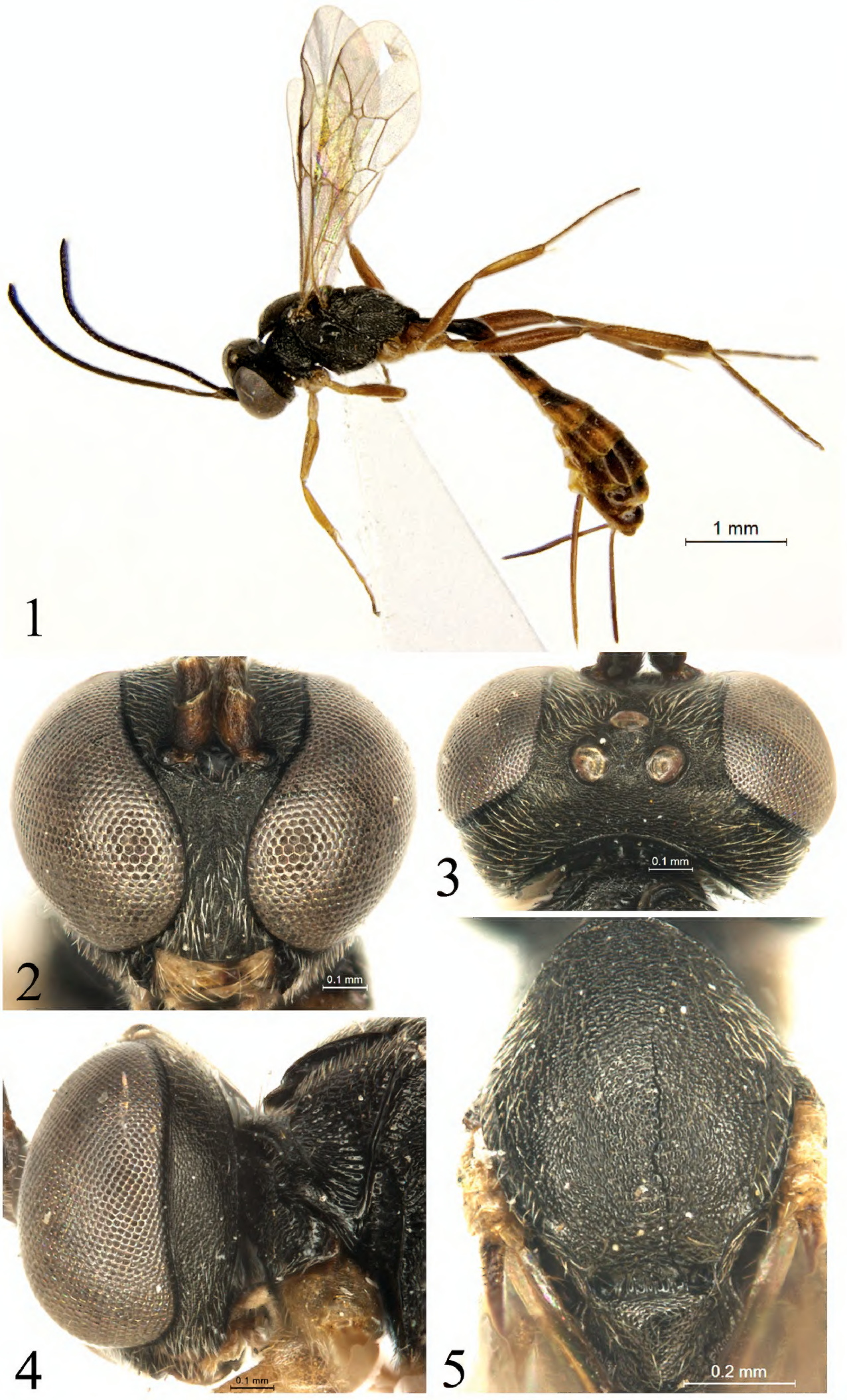
***Cymodusa culaiica* Sheng, Li & Sun, sp.nov.**
http://zoobank.org/79D8F06D-76CC-42CF-A4ED-51676D39CD21
Figures 1–9

Diagnosis. Head, mesosoma and all tergites coriaceous. Anterior tentorial pit obscure, against eye. Areolet sessile (Fig. 1). Nervellus not intercepted. Area basalis of propodeum (Fig. 7) elongate, 2.5–2.7× as long as anterior width, 3.6× as long as posterior width; lateromedian longitudinal carinae from base of area superomedia evenly strongly divergent posteriorly. Legs almost entirely yellowish brown. Posterior 0.5–0.8 of tergites 3 and 4 reddish brown.

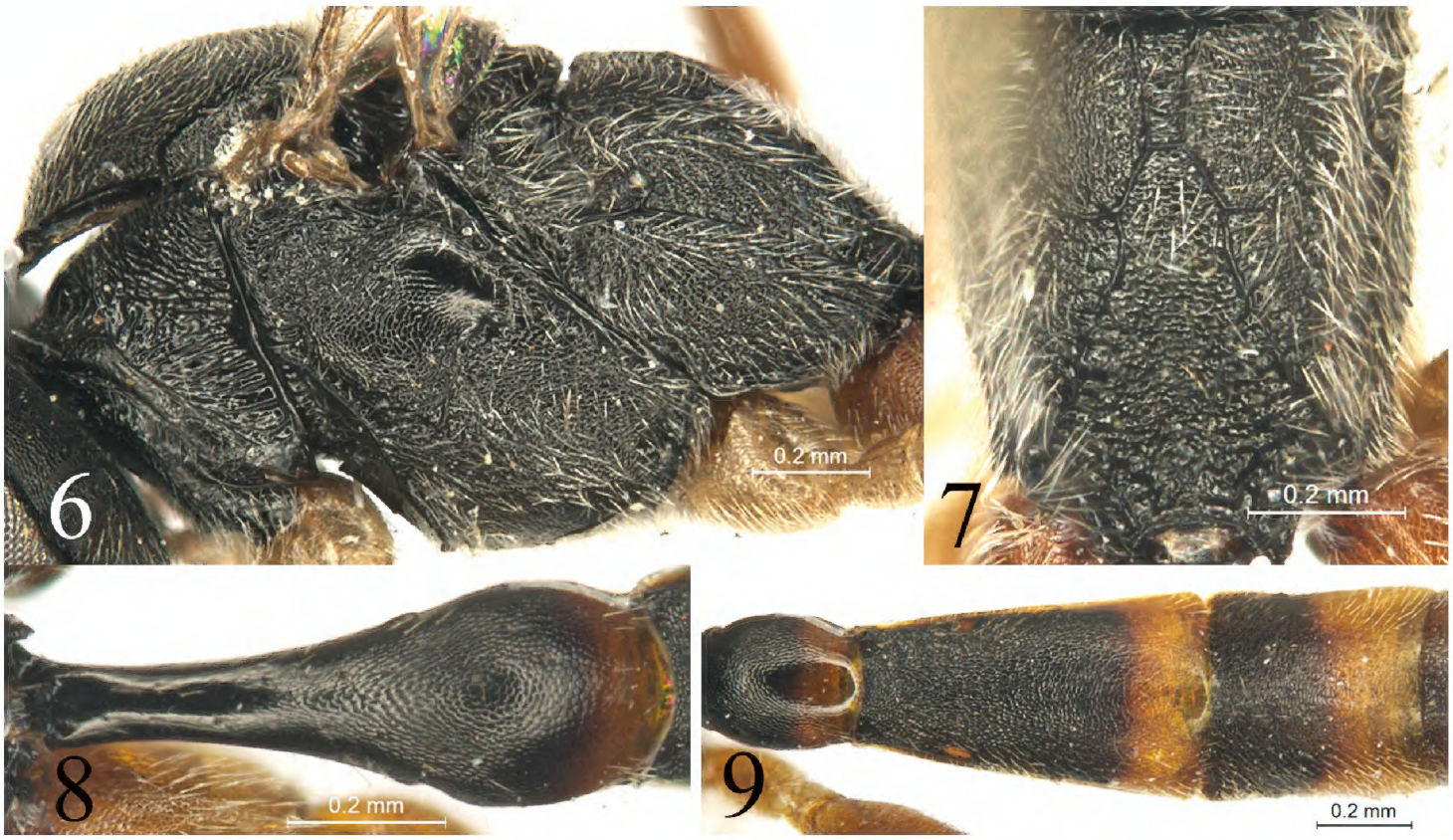
Description. Body length 4.0–5.0 mm. Fore wing length 2.2–2.5 mm. Ovipositor sheath 0.8–1.0 mm.

Head. Head with coriaceous surface. Eye (Figs 2–4) large. Median portion of inner margins of eyes (Fig. 2) slightly concave near antennal sockets. Eye with weak, short setae. Face and clypeus with dense gray white setae. Face strongly convergent ventrally, maximum width beneath antennal socket approximately 2.5× as long as minimum width; sublateral portion of upper margin, beneath antennal socket, distinctly raised. Clypeus slightly convex medially, apical margin slightly convex forward. Anterior tentorial pit small, obscure, against eye. Mandible with fine indistinct punctures; lower tooth as long as upper tooth. Malar space very narrow, almost absent. Gena, vertex and frons (Figs 3, 4) with dense gray setae. Gena strongly convergent backward. Posterior portion of vertex behind hind margin of stemmaticum steeply oblique. Stemmaticum raised. Postocellar line 1.1–1.2× as long as ocular-ocellar line. Frons almost flat, lower portion with fine indistinct wrinkles. Antenna with 24–25 flagellomeres; ratio of length from first to fifth flagellomeres: 1.1:0.7:0.7:0.7:0.6. Occipital carina (Fig. 3) complete, dorsal portion evenly arched.

Mesosoma. Lateral concavity of pronotum (Figs 4, 6) with dense strong oblique wrinkles; dorsoposterior portion rough, with short indistinct transverse wrinkles. Epomia present. Mesoscutum (Fig. 5) evenly convex. Notaulus indistinct. Scuto-scutellar groove with distinct longitudinal carinae. Scutellum slightly convex, with dense thin setae. Postscutellum strongly narrowed anteriorly, anterolaterally with small pit. Lower half of mesopleuron (Fig. 6) slightly convex, with short indistinct wrinkles; speculum slightly convex, relatively small, smooth, shiny. Epicnemial carina strong, upper end al-



Figures 1–5. *Cymodusa culaiica* Sheng, Li & Sun, sp. nov. Holotype. Female **1** habitus, lateral view **2** head, anterior view **3** head, dorsal view **4** head and pronotum, lateral view **5** mesoscutum and scutellum, dorsal view.



Figures 6–9. *Cymodusa culaiica* Sheng, Li & Sun, sp. nov. Holotype. Female **6** mesosoma, lateral view **7** propodeum, dorsal view **8** first tergite, dorsal view **9** postpetiole and tergites 2 and 3, dorsal view.

most reaching front edge of mesopleuron, about 0.6 distance to subtegular ridge. Metapleuron evenly convex; juxtacoxal carina absent; submetapleural carina complete. Hind femur 5.0× as long as its maximum width. Ratio of length of hind tarsomeres from first to fifth: 3.2:1.5:1.0:0.6:0.7. First tarsomere 2.2× as long as length of longer spur. Claw small, weakly pectinate. Wings slightly gray, hyaline. Fore wing with vein 1cu-a almost opposite M&RS. Areolet sessile, receiving vein 2m-cu approximately 0.45× distance from vein 2rs-m to 3rsm, 2rs-m slightly longer than 3rs-m; postnervulus intercepted almost at middle. Hind wing with basal portion of M+CU distinctly arched; nervellus not intercepted, almost vertical. Propodeum (Fig. 7) evenly convex, apical portion evenly oblique; area basalis separated from area superomedia by distinct carina, slightly convergent posteriorly, 2.5–2.7× as long as anterior width, 3.6× as long as posterior width; lateromedian longitudinal carinae from base of area superomedia evenly strongly divergent posteriorly; areas superomedia and petiolaris completely confluent, with short, indistinct transverse wrinkles; costula present. Propodeal spiracle small, circular.

Metasoma. First tergite (Fig. 8) 2.6–2.8× as long as apical width, basal half smooth, shiny, apical half shagreened; postpetiole distinctly convex, subapical portion widened; spiracle small, located approximately at apical 0.3. Tergites 2–3 (Fig. 9) slightly rough, posterior portions with indistinct fine punctures. Second tergite elongate, slightly widened posteriorly, 1.7–1.8× as long as posterior width. Third tergite with parallel sides, 1.0–1.1 × as long as posterior width. Tergites 4 to 5 widened posteriorly. Ovipositor sheath almost (0.98×) as long as hind tibia. Ovipositor compressed, with sharp dorsal notch.

Coloration (Fig. 1). Black, except for the following: ventral profile of base of antenna brownish. Mandible except teeth, maxillary palpi, labial palpi and tegula yellow.

Legs yellowish brown, except fore and middle coxae and ventral profiles of trochanters brownish yellow; apical portion of hind tibia slightly black brown. Pterostigma and veins blackish brown. Metasomal tergites brownish black, posterior portions of tergites 1, 2, 6 and 7, posterior 0.5–0.8 of tergites 3 to 5 reddish brown.

Etymology. The specific name is derived from the type locality.

Material examined. ***Holotype*:** China • ♀; Shandong, Chashankou, Culaishan Natural Reserve, Tai'an; 2.VI.2018; IT by Tao Zhao. ***Paratypes*:** China • 13♀♀; same data as for holotype except 26.V.–9.VI.2018.

Distribution. China.

Differential diagnosis. The new species is similar to *C. orientalis* Uchida, 1956, but can be distinguished easily from the preceding key.

Cymodusa melana Sheng, Li & Sun, sp.nov.

http://zoobank.org/AF8594AF-77DB-4B6F-910D-FBC73292266B

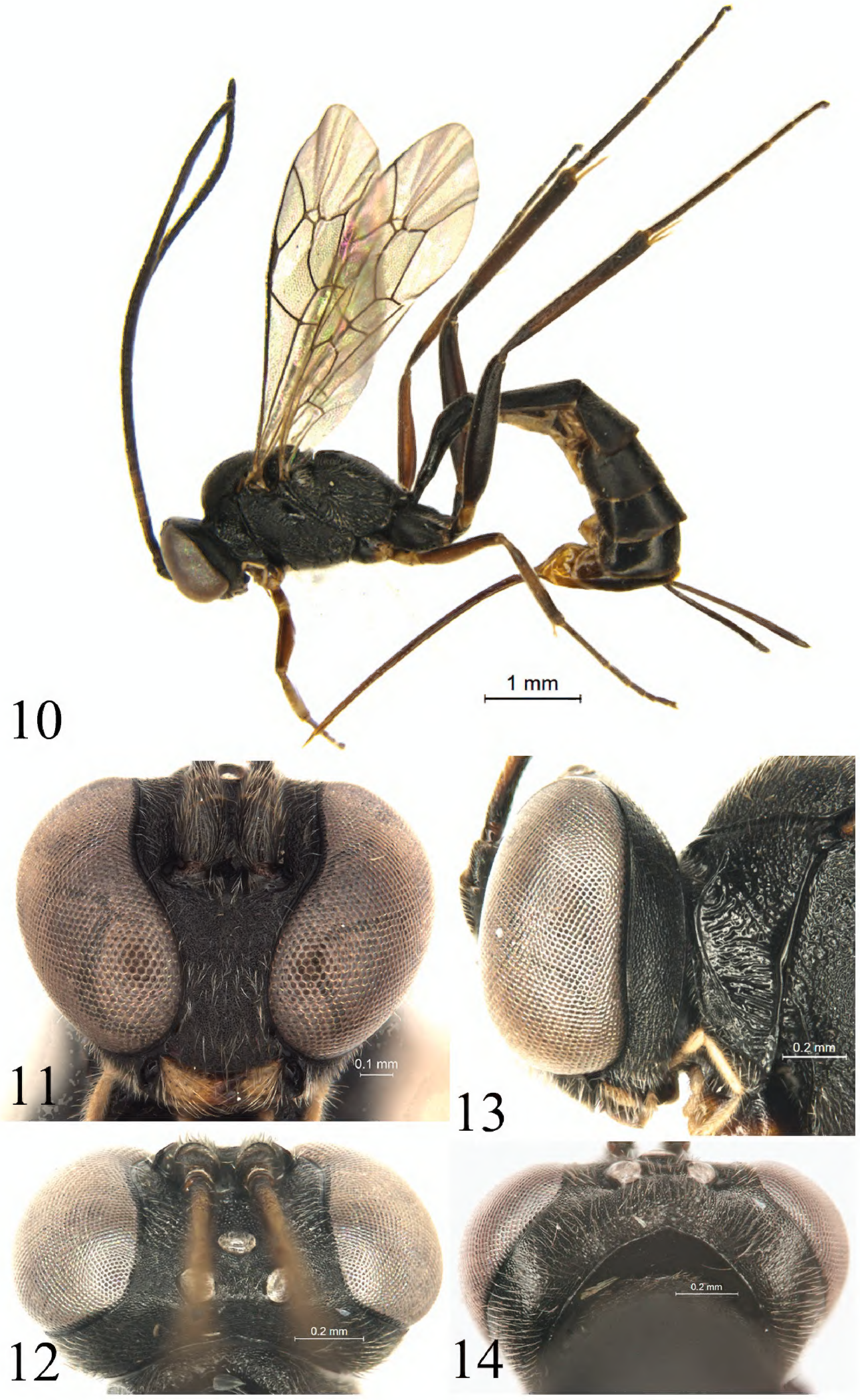
Figures 10–20

Diagnosis. Dorsal median portion of occipital carina (Fig. 14) angled. Anterior tentorial pit distinct, against eye. Postocellar line approximately 1.2× as long as ocular-ocellar line. Lateral carinae of area basalis almost parallel, 1.2–1.3× as long as wide. Lateromedian longitudinal carinae distinctly angled in level of posterior transverse carina. Tergites 2 (Fig. 19) elongate, 1.7–1.8× as long as posterior width. Posteromedian portions of tergites 6–7 (Fig. 20) distinctly concave. Head, mesosoma, all metasomal tergites and hind leg almost entirely black.

Description. Body length 7.0–7.5 mm. Fore wing length 3.5–4.0 mm. Ovipositor sheath 1.2–1.5 mm.

Head. Eye with weak, short setae, inner margins (Fig. 11) distinctly concave near antennal sockets. Face and clypeus roughly shagreened. Face strongly convergent ventrally, maximum width beneath antennal socket approximately 1.8× as long as minimum width, dorsal margin concave medially. Clypeus with dense fine punctures, evenly convex, apical margin evenly convex forward. Anterior tentorial pit small, distinct, against eye. Mandible with dense yellowish white setae and sparse fine punctures; lower tooth almost as long as upper tooth. Malar space about 0.1× as long as basal width of mandible. Gena (Figs 12, 13, 14) shagreened, lower portion with dense delicate yellowish white setae, upper portion strongly convergent backward. Vertex finely shagreened, posterior portion behind hind margin of stemmaticum steeply oblique. Postocellar line approximately 1.2× as long as ocular-ocellar line. Frons almost flat, shagreened, median portion with fine indistinct transverse wrinkles. Antenna with 32 flagellomeres; ratio of length from first to fifth flagellomeres: 2.0:1.3:1.2:1.2:1.1. Occipital carina (Fig. 14) complete, dorsal median portion angulated.

Mesosoma. Lateral concavity of pronotum (Figs 13, 16) with dense strong oblique wrinkles; dorsoposterior portion roughly shagreened. Epomia long and strong. Mesoscutum (Fig. 15) evenly convex, with leathery texture, lateral portion



Figures 10–14. *Cymodusa melana* Sheng, Li & Sun, sp.nov. Holotype. Female **10** habitus, lateral view **11** head, anterior view **12** head, dorsal view **13** head and pronotum, lateral view **14** head, dorsoposterior view.

Figures 15–20. *Cymodusa melana* Sheng, Li & Sun, sp. nov. Holotype. Female **15** mesoscutum and scutellum, dorsal view **16** mesosoma, lateral view **17** propodeum, dorsal view **18** first tergite, lateral view **19** postpetiole and tergite 2, dorsal view **20** (Paratype) Posterior portion of metasoma, dorsal view.

with fine distinct punctures, distance between punctures 0.2–1.5× as long as one diameter of puncture; posterior portion with short indistinct transverse wrinkles. Notaulus indistinct. Scuto-scutellar groove with 6–7 distinct longitudinal carinae. Scutellum finely shagreened, basal 0.25 with lateral carina. Postscutellum transversely convex, anterior portion depressed transversely, anterolateral with small pit. Lower half of mesopleuron (Fig. 16) slightly convex; median portion in front of speculum with distinct oblique wrinkles; beneath subtegular ridge with short indistinct transverse wrinkles. Speculum almost smooth, shining. Epicnemial carina strong, upper end almost reaching front edge of mesopleuron, about 0.7 distance to subtegular ridge. Metapleuron evenly convex, with dense grayish white setae;

juxtacoxal carina absent; submetapleural carina complete. Hind femur 5.7–6.0× as long as its maximum width. Ratio of length of hind tarsomeres from first to fifth: 5.5:2.7:1.7:1.0:1.0. First tarsomere 2.4× as long as length of longer spur. Claw small, pectinate basally. Wings slightly brownish, hyaline. Fore wing with vein 1cu-a slightly basal of M&RS. Areolet sessile, receiving vein 2m-cu approximately at middle, 2rs-m approximately as long as 3rs-m; postnervulus intercepted at middle. Hind wing with basal portion of M+CU distinctly arched; nervellus almost vertical, intercepted at lower 0.25; final abscissa of CU unpigmented. Propodeum (Fig. 17) roughly shagreened, lateral portion with dense gray setae; lateromedian longitudinal carinae strong, distinctly angled in level of posterior transverse carina; area basalis separated from area superomedia by weak carina, lateral sides slightly convergent anteriorly or parallel, 1.6–1.7× as long as anterior width, 1.2–1.3 × as long as posterior width; areas superomedia slightly wider than long; areas superomedia and petiolaris completely confluent, with short, indistinct transverse wrinkles; costula present. Propodeal spiracle small, circular.

Metasoma. First tergite (Fig. 18) 3.2× as long as apical width; petiole smooth, shiny, lateral side slightly longitudinally concave; postpetiole (Fig. 19) distinctly convex, shagreened; spiracle small, weakly convex, located approximately at apical 0.35. Tergites 2 (Fig. 19) with texture as postpetiole, elongate, slightly evenly widened posteriorly, 1.7–1.8× as long as posterior width. Tergite 3 with parallel sides, 1.3× as long as posterior width. Fourth and subsequent tergites compressed. Posteromedian portions of tergites 6–7 (Fig. 20) distinctly concave. Ovipositor sheath 1.2× as long as hind tibia. Apical portion of ovipositor weakly compressed, with sharp dorsal notch.

Coloration (Fig. 10). Black, except for the following: ventral profile of base of antenna reddish brown. Mandible except teeth, maxillary palpi, labial palpi yellow. Tegula, fore and middle legs reddish brown, except coxae black and ventral profiles of trochanters darkish brown. Hind trochantellus yellow. Base of hind femur reddish brown. Pterostigma and veins blackish brown.

Etymology. The specific name is derived from the body and hind leg almost entirely black.

Material examined. ***Holotype*:** China • ♀; Guizhou, Lengjiaba, 840 m, Fanjingshan National Natural Reserve, Jiangkou; 24.VI.2019; IT by Zhen-Hai Yang. ***Paratypes*:** China • 1♀; same data as for holotype. • 1♀; same data as for holotype except 23.IX.2019. China • 2♀♀; Guizhou, Panlongshan, 1179 m, Wudang, Guiyang; 24.VI.2019; IT by Zai-Hua Yang.

Distribution. China.

Differential diagnosis. The new species is similar to *C. taprobanica* (Cameron, 1905), but can be distinguished from the latter by the following combination of characters: areolet sessile; area basalis of propodeum at most 1.7× as long as maximum width; area superomedia wider than length; hind leg almost entirely black. *Cymodusa taprobanica* (Cameron): areolet petiolate; area basalis of propodeum about 3.0× as long as wide; area superomedia longer than width; hind leg partly black.

Discussion

According to Watanabe's report (Watanabe, 2020), the area basalis of the propodeum of *Cymodusa orientalis* Uchida, 1956 shows strong variation: slightly to strongly convergent posteriorly, even triangular (also see Dbar, 1985). The original description of *C. josephi* stated that the hind wing nervellus is intercepted; in *C. orientalis* the hind wing nervellus is not intercepted; and the character of area basalis of propodeum is within the range of *C. orientalis*. The specimens in our collections, collected from Guangxi, Guizhou and Jiangxi, located at the north border of Oriental region, and Shandong and Sichuan, located at the south border of the Eastern Palaearctic region, almost entirely with same characters, except some of them have the nervellus obscurely intercepted, the remainder with the nervellus not intercepted. For a decision, the types of *C. josephi* Gupta & Gupta, 1974, *C. orientalis* Uchida, 1956, *C. aenigma* Dbar, 1985 and more similar material should be studied in the future, or more accurate assessments will be helped by molecular methods.

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